Technical Specification
IQ65033QMA10

36-75V @ 10Amp Input/Output	3.3V & 5.0V MGMT Power	Quarter-Brick ATCA Power Interface Module

The IQ65033QMA10 iQor™ Power Interface Module integrates all features required by the AdvancedTCA Base Specification into a Quarter-Brick footprint. The iQor offers industry leading external hold-up capacitor volumetric density for a compact overall solution. At a 90V hold-up capacitor voltage (trimmable 50-95V), only 564µF is required to achieve 8.70ms hold-up time at 200Win. The -48V output voltage is conditioned for smooth operation through severe input transient events. The iQor is designed thermally and electrically to drive high power wide-range-input DC/DC converters such as the 300W SynQor PQ60120QEA25. RoHS Compliant (see page 12).

IQ65033QMA10 Module

Operational Features

- Input ORing for A & B power feeds (MOSFET-based for low power dissipation)
- Hot swap control with seamless ride-through of input voltage transient
- EMI filter meets CISPR 22 Class B when used as directed (see applications section)
- External hold-up capacitor trimmable from 50V to 95V
- Automatic discharge of external hold-up capacitor
- Isolated management power of 3.3V at 3.6A and 5.0V at 150mA
- Dual input side enable
- PMBus compliant I²C interface data reporting (optional)

Mechanical Features

- Industry standard quarter-brick size: 1.45″ x 2.3″ (36.8x58.4mm)
- Overall height of 0.54″ (13.7mm), permits better air-flow and smaller card pitch
- Total weight: 1.2 oz. (34 grams)
- Flanged pins designed to permit surface mount soldering (avoiding wave solder) using FPiP technique
- External hold-up capacitor footprint much smaller than other solutions currently available on the market

Protection Features

- Management power over-voltage protection
- Management power over-current protection
- Main output over-current protection
- Thermal shutdown protects the unit from abnormal environmental conditions
- ORing MOSFET failure alarm
- Input fuse/feed loss alarm

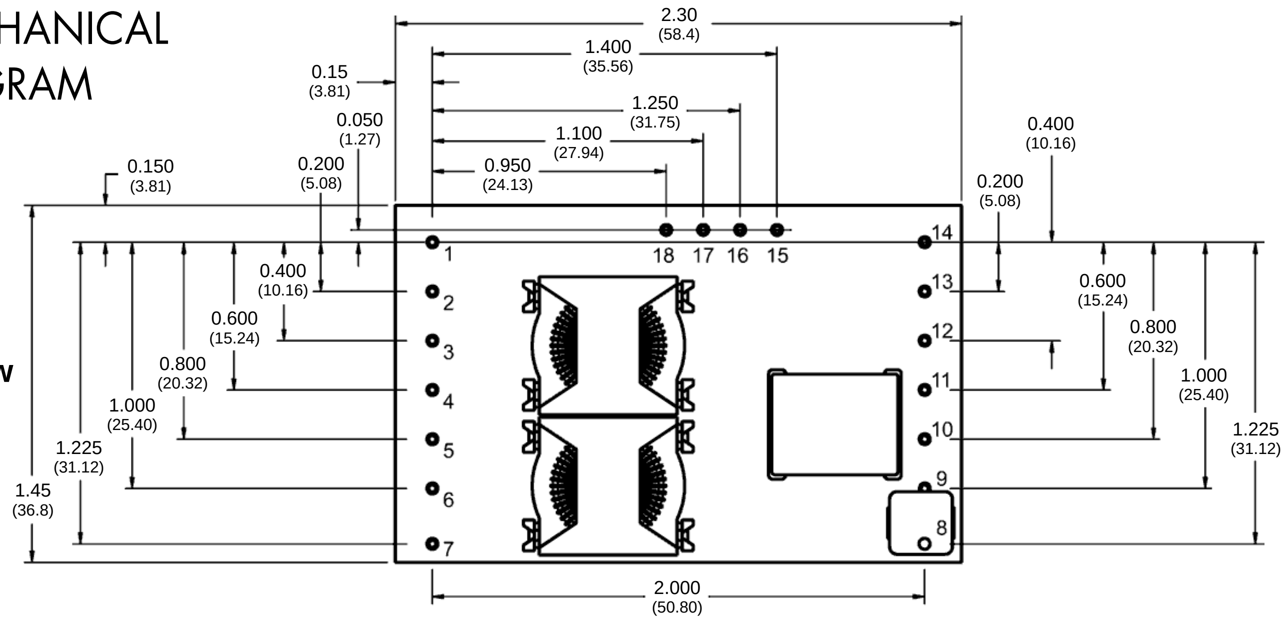
Safety Features

- 2250V, 30 MΩ VRTN_A/B to LOGIC_GND and SHELF_GND isolation
- UL/cUL 60950-1 recognized (US & Canada), basic insulation rating
- TUV certified to EN60950-1
- Meets 72/23/EEC and 93/68/EEC directives which facilitates CE Marking in user's end product
- Board and plastic components meet UL94V-0 flammability requirements

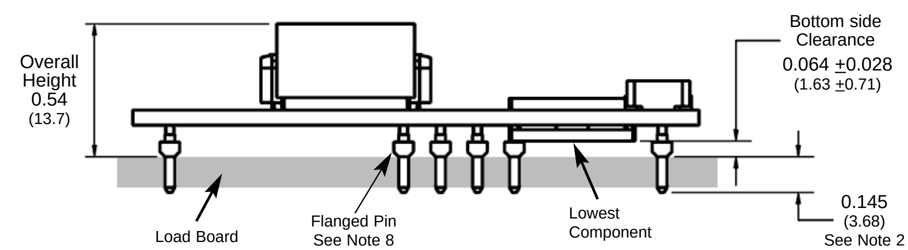
* Final datasheet pending ECO review and signature.

MECHANICAL DIAGRAM

Top View



Side View



NOTES

1) All Pins are 0.040" (1.02mm) diameter with 0.080" (2.03 mm) diameter standoff shoulders.
2) Other pin extension lengths available. Recommended pin length is 0.03" (0.76mm) greater than the PCB thickness.
3) All Pins: Material - Copper Alloy
   Finish - Matte Tin over Nickel plate
4) Undimensioned components are shown for visual reference only.
5) All dimensions in inches (mm)
   Tolerances: x.xx ±0.02 in. (x.x ±0.5mm)
   x.xxx ±0.010 in. (x.xx ±0.25mm)
6) Weight: 1.2 oz. (34 g) typical
7) Workmanship: Meets or exceeds IPC-A-610C Class II
8) The flanged pins are designed to permit surface mount soldering (allowing to avoid the wave soldering process) through the use of the flanged pin-in-paste technique.

PIN DESIGNATIONS

Pin No.	Name	Function
1	-48V_A	Negative A Feed (Externally Fused)
2	-48V_B	Negative B Feed (Externally Fused)
3	VRTN_A	Positive A Feed (Externally Fused)
4	VRTN_B	Positive B Feed (Externally Fused)
5	ENABLE_A	Enable A Input (Externally Fused)
		(Short Pin Tied to VRTN_A on Backplane)
6	ENABLE_B	Enable B Input (Externally Fused)
		(Short Pin Tied to VRTN_B on Backplane)
7	SHELF_GND	Shelf Ground
8	5.0V	5.0V (Relative to LOGIC_GND)
9	3.3V	3.3V (Relative to LOGIC_GND)
10	*I2C_ADR*	*I2C Address Input **
		*(Connect External Resistor to LOGIC_GND) ***
11	*I2C_DAT*	*I2C Data (Relative to LOGIC_GND) **
12	*I2C_CLK*	*I2C Clock (Relative to LOGIC_GND) **
13	LOGIC_GND	Logic Ground
14	ALARM	Isolated A/B Feed Loss or Open Fuse Alarm
		(Relative to LOGIC_GND)
15	-48V_OUT	Negative Output to Payload Power Converter
16	HU_TRIM	Hold-Up Voltage Trim
		(Connect External Resistor to -48V_OUT)
17	VRTN_OUT	Positive Output to Payload Power Converter
18	HU_CAP	Positive Connection to Hold-Up Capacitor
		(Negative Connection to -48V_OUT)

* Pins 10, 11, and 12 are only available on the full feature version. See the ordering page for more information.
** Single resistor connected externally to LOGIC_GND selects the three least significant bits of I2C address "0101xxx".

IQ65033QMA10 ELECTRICAL CHARACTERISTICS

Specifications subject to change without notice. Specifications in **bold** are guaranteed by design over the temperature range -40° to 125°C.

Parameter	Min.	Typ.	Max.	Units	Notes & Conditions
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Continuous			-75	V	Limited by internal TVS zener diode
Transient			-100	V	1ms transient, square wave
Reverse Polarity			+75	V	No damage, low current, output diode clamped
Isolation Voltage					
(VRTN_A/B to LOGIC_GND)			2250	V	
(VRTN_A/B to SHELF_GND)			2250	V	
Operating Temperature	-40		100	°C	Subject to thermal derating; see Figures 1 & 3
Storage Temperature	-55		125	°C	
Hold-up Capacitor Voltage (Relative to -48V_OUT)			100	V	
-48V DUAL FEED INPUT CHARACTERISTICS					
Normal Operating Input Voltage Range	-36	-48	-75	V	
Operating Current			10	A	25°C 950 LFM, Vin = -48V; see Figure 1
Disabled Input Current below Turn-Off Threshold		8	**10**	mA	
Enabled No-Load Input Current		21	30	mA	Vin = -48V
Internal Input Filter Capacitance (Not Hot-Swapped)		18	22	µF	Should be precharged by resistors to EARLY_A/B pins
Recommended EARLY_A/B Resistors		100		Ω	Surge rated 2010 case size (KOA SG73 series or equivalent)
Recommended Input Fuses			15	A	
3.3V ISOLATED MANAGEMENT POWER (Always On)					
Startup Delay					Time from ENABLE_A/B to 3.3/5.0Vout
At 36Vin		0.43	**0.50**	s	
At 48Vin		0.31		s	
At 75Vin	**0.15**	0.20		s	
Turn-On Rise Time	1	5	20	ms	0% to 90%; see Figure 10
Input Under-Voltage Lockout					
Turn-On Voltage Threshold	**-33.5**	-34.5	**-36.0**	V	At Mangement Power Converter input; see Figure A
Turn-Off Voltage Threshold	**-32.0**	-34.0	**-35.5**	V	"
Total Output Voltage Range	**3.170**	3.350	**3.430**	V	Including line, load, sample, life, and temp
Output Voltage Ripple and Noise					See Figure 12
Peak-to-Peak		40	75	mV	Full load, 10µF ceramic, 500MHz bandwidth
RMS		16	30	mV	"
Operating Output Current Range	0		3.6	A	Subject to thermal derating; see Figures 1 & 3
Output DC Current-Limit Inception	3.9	5.4	6.9	A	
Current Limit Shutdown Voltage		1.5		V	Initiates hiccup mode
Hiccup Mode Restart Time		130		ms	Vin = -48V
Back-Drive Current			**10**	mA	Negative current drawn from output source
Maximum Output Capacitance			1000	µF	
Switching Frequency	200	220	240	kHz	
Over-Voltage Protection Setpoint	**4.10**	4.33	**4.55**	V	
5.0V POWER (Linear Regulated From ~6.6V)					
Total Output Voltage Range	**4.80** [1]	5.00	**5.20**	V	Including line, load, sample, life, and temp
Operating Output Current Range	0		150	mA	
Short Circuit Current		400		mA	Independent Thermal Protection
Back-Drive Current			**1**	mA	Negative current drawn from output source
Maximum Output Capacitance			1000	µF	
-48V OUTPUT					
Efficiency					No load on 3.3V/5.0V outputs, Vin = -48V
300W Output Power	97.7	98.2			
200W Output Power	98.0	98.5			
Equivalent Resistance From Input Feed		120	200	mΩ	
Recommended External Output Filter Capacitance	80	100	270	µF	Maximum DC load at startup is 50 mA
-48V OUTPUT HOT-SWAP					
Hot-Swap Startup Ramp dV/dt	**150**	200	**250**	V/s	
Input Current Limit (Turns Off Hot-Swap Momentarily)	15	17.5	20	A	Hold-up still active
Input dV/dt Limit (Turns Off Hot-Swap Momentarily)		40		V/ms	"
Short Circuit Duration to Initiate Hiccup Mode		2		ms	
Restart Time in Hiccup Mode	**1.8**	2.0	**2.2**	s	
INPUT ORING					
ORing MOSFET Turn On Current	**0.4**	1.0	**2.4**	A	
ORing MOSFET Turn Off Current	**0.1**	0.4	**1.1**	A	
ORing MOSFET Current Hysteresis	**0.3**	0.6	**1.3**	A	
Turn On Time		600		µs	
Turn Off Time		0.25		µs	
DUAL ENABLE INPUT CHARACTERISTICS					
ENABLE_A/B Threshold	**26.0**	29.0	**31.0**	V	At input feed voltage -48V_A/B; see Figure A
Current Drain per Enable Pin (Vin = -75V)			**0.36**	mA	
TEMPERATURE LIMITS FOR POWER DERATING CURVES					
Semiconductor Junction Temperature			125	°C	Package rated to 150°C
Board Temperature			125	°C	UL rated max operating temp 130°C
Transformer Temperature			125	°C	See Figure 3 for derating curve

Note 1: If the 5.0V load current exceeds 100mA, up to 200mV of additional voltage drop is possible on the 5.0V output.

IQ65033QMA10 ELECTRICAL CHARACTERISTICS (Continued)

Specifications subject to change without notice. Specifications in **bold** are guaranteed by design over the temperature range -40° to 125°C.

Parameter	Min.	Typ.	Max.	Units	Notes & Conditions
HOLD-UP CAPACITOR INTERFACE					
Hold-up Capacitor Trim Range	50	90	95	V	Can be set either above or below input voltage
Hold-up Capacitor Charge Accuracy	**87.2**	90.0	**92.8**	V	2.49kΩ external trim resistance, 1% 100ppm/°C
Hold-up Capacitor Charge Current		40		mA	
Switching Frequency	**405**	450	**495**	KHz	
-48V_OUT Threshold					Hold-up operation with Vin<43V not required by ATCA spec
To Arm Hold-up	**-36.9**	-38.9	**-40.9**	V	At VRTN_OUT w.r.t. -48V_OUT; see Figure A
To Initiate Hold-up Connect	**-36.4**	-38.4	**-40.4**	V	"
Hysteresis		0.55		V	"
dV/dt on Hold-up Connect		80		V/ms	
Duration of Hold-up Connect		0.1		s	
Delay Before Hold-up Connect is (Re)Armed		2		s	
Hold-up Capacitor Discharge Resistance	**1.55**	1.65	**1.75**	kΩ	
Maximum Hold-up Capacitance			3300	µF	Yields 55ms (200W at 90V cap charge)
ISOLATED ALARM OUTPUT (Alarm = HiZ)					
Input A/B Feed Voltage Alarm Threshold	**36.4**	38.4	**40.4**	V	At input feed voltage -48V_A/B; see Figure A
Open Circuit Voltage			40	V	
On-State Voltage		0.2	**0.4**	V	At 50mA
On-State Transistor Collector Current			50	mA	
Off-State Transistor Collector Current			1	µA	
OVER-TEMPERATURE PROTECTION					
Shutdown Point		135		°C	Does not shut down Management Power
Restart Hysteresis		10		°C	Automatic restart
RELIABILITY CHARACTERISTICS					
Calculated MTBF (Telcordia)		3.6		10^6 Hrs.	TR-NWT-000332; 80% load,300LFM, 40°C T_a
Calculated MTBF (MIL-217)		3.27		10^6 Hrs.	MIL-HDBK-217F; 80% load, 300LFM, 40°C T_a
Field Demonstrated MTBF				10^6 Hrs.	See website for details

STANDARDS COMPLIANCE

Parameter	Notes
STANDARDS COMPLIANCE	
UL/cUL 60950-1	File # E194341, Basic insulation & pollution degree 2
EN60950-1	Certified by TUV
72/23/EEC	
93/68/EEC	
Needle Flame Test (IEC 695-2-2)	Test on entire assembly; board & plastic components UL94V-0 compliant
IEC 61000-4-2	ESD test, 8kV - NP, 15kV air - NP (Normal Performance)
GR-1089-CORE	Section 7 - electrical safety, Section 9 - bonding/grounding
Telcordia (Bellcore) GR-513	

- An external input fuse must always be used to meet these safety requirements. Contact SynQor for official safety certificates on new releases or download from the SynQor website.

QUALIFICATION TESTING

Parameter	# Units	Test Conditions
QUALIFICATION TESTING		
Life Test	32	95% rated Vin and load, units at derating point, 1000 hours
Vibration	5	10-55Hz sweep, 0.060" total excursion,1 min./sweep, 120 sweeps for 3 axes
Mechanical Shock	5	100g minimum, 2 drops in x and y axis, 1 drop in z axis
Temperature Cycling	10	-40°C to 100°C, unit temp. ramp 15°C/min., 500 cycles
Power/Thermal Cycling	5	$T_{operating}$ = min to max, Vin = min to max, full load, 100 cycles
Design Marginality	5	T_{min}-10°C to T_{max}+10°C, 5°C steps, Vin = min to max, 0-105% load
Humidity	5	85°C, 85% RH, 1000 hours, 2 minutes on and 6 hours off
Solderability	15 pins	MIL-STD-883, method 2003

- Extensive characterization testing of all SynQor products and manufacturing processes is performed to ensure that we supply robust, reliable product. Contact the factory for official product family qualification documents.

OPTIONS

SynQor provides various options for Pin Length and Feature Set for this family of Power Interface Modules. Please consult the last page for information on available options.

PATENTS

SynQor is protected under various patents. Please consult the last page for further information.

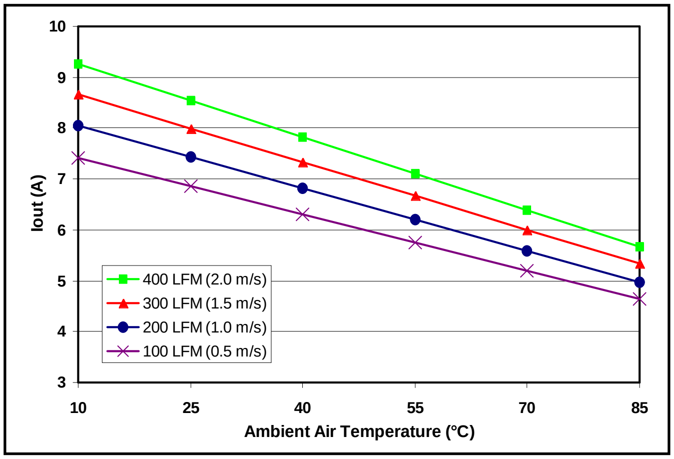


Figure 1: *-48V output (maximum power) derating curves vs. ambient air temperature for airflow rates of 100 LFM through 400 LFM with air flowing across the converter from pin 7 to pin 1 (48 Vin, 3.3V mgmt power output @ 1.5 A).*

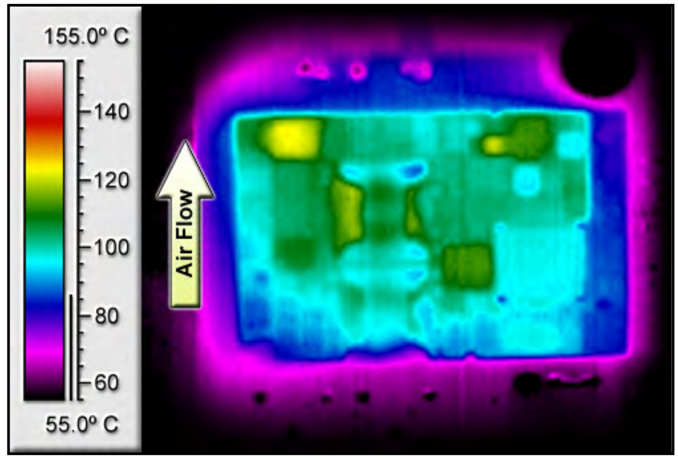


Figure 2: *Thermal plot of converter at 6.2A load current from -48V output (298W) with 55°C air flowing at the rate of 200 LFM. Air is flowing across the converter from pin 7 to pin 1 (48 Vin, 3.3V output @ 1.5 A).*

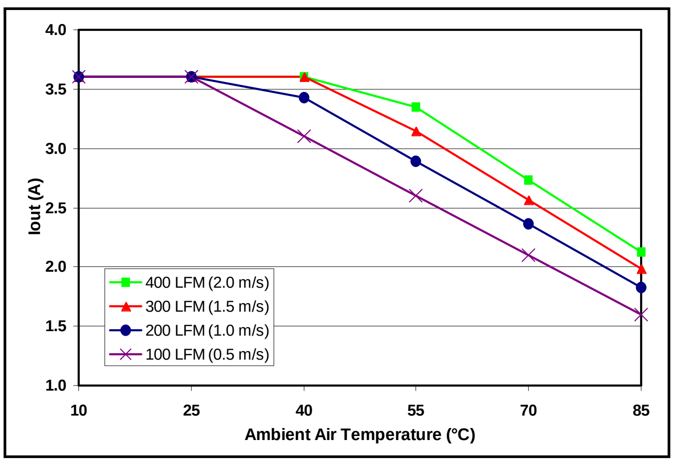


Figure 3: *3.3V output (maximum power) derating curves vs. ambient air temperature for airflow rates of 100 LFM through 400 LFM with air flowing across the converter from pin 7 to pin 1 (48 Vin, main output power output @ 4 A).*

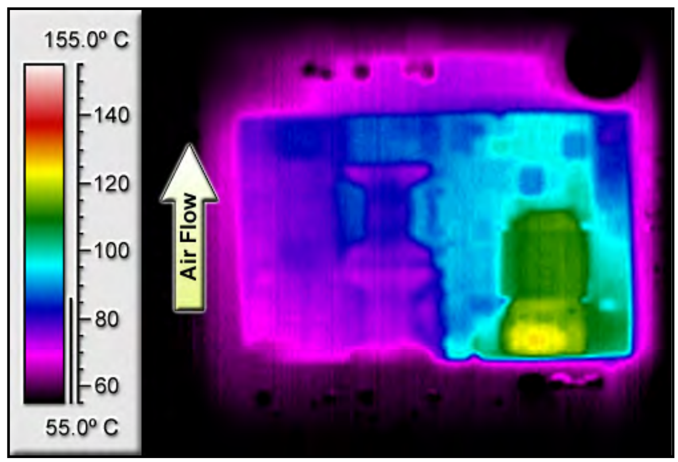


Figure 4: *Thermal plot of converter at 2.9A load current from 3.3V output (9.6W) with 55°C air flowing at the rate of 200 LFM. Air is flowing across the converter from pin 7 to pin 1 (48 Vin, -48V output @ 4 A).*

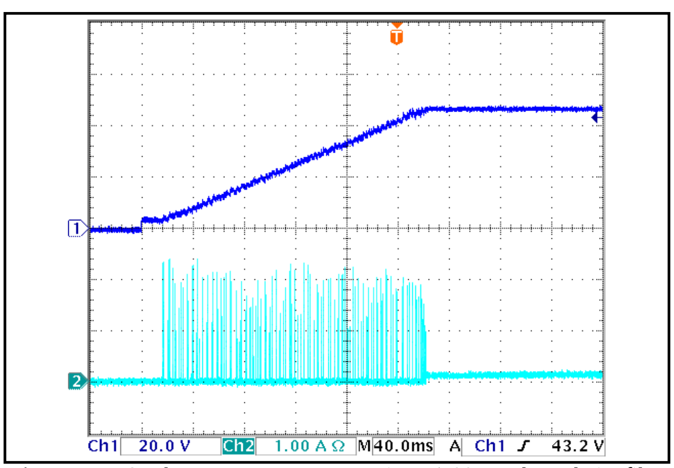


Figure 5: *48V hot-swap turn-on transient (100uF electrolytic filter capacitor CF). Top trace: VRTN_OUT w.r.t. -48V_OUT (20V/div), Bottom trace: Input Feed Current (2A/div).*

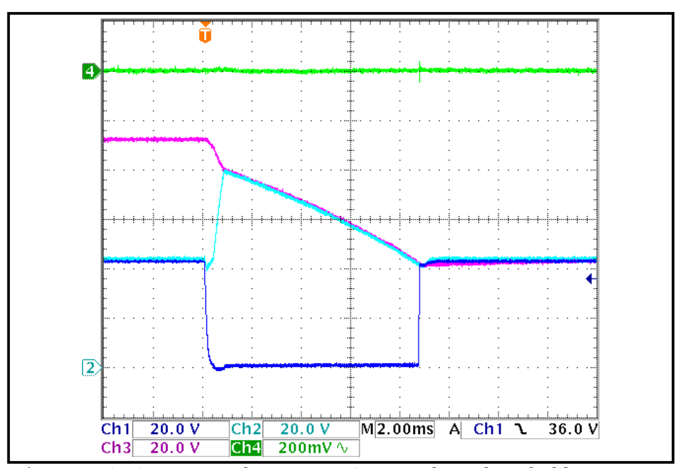


Figure 6: *8.70ms zero volt transient (564uF electrolytic hold-up capacitor CH, 100uF electrolytic filter capacitor CF). Ch 1: Input Feed A/B Voltage (20V/div). Ch 2: VRTN_OUT w.r.t. -48V_OUT (20V/div). Ch 3: HU_CAP w.r.t. -48V_OUT (20V/div). Ch 4: 3.3V_OUT (200mV/div).*

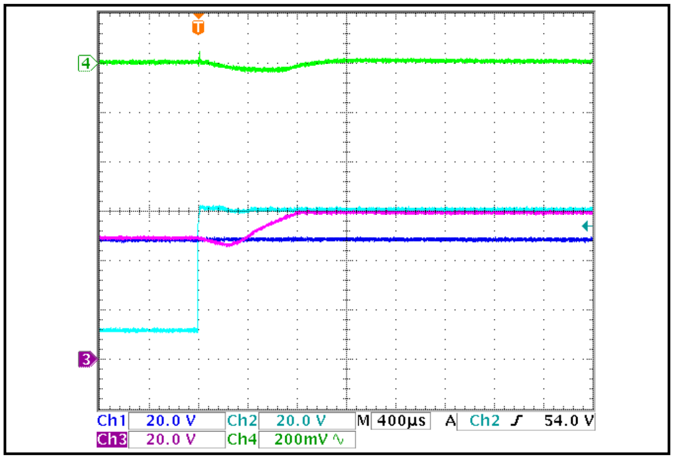


Figure 7: *Instantaneous input transient from 48V Feed A to 60V Feed B. Ch 1: Input Feed A Voltage (20V/div). Ch 2: Input Feed B Voltage (20V/div). Ch 3: VRTN_OUT w.r.t. -48V_OUT (20V/div). Ch 4: 3.3V_OUT (200mV/div).*

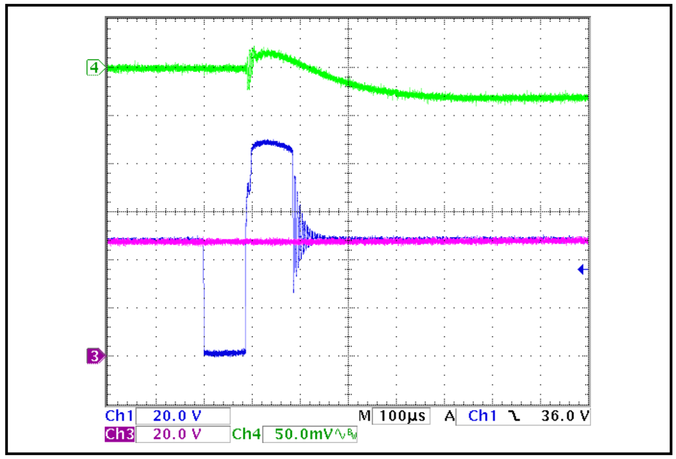


Figure 8: *Inductive Switching event on Feed A from 48V to 0V to TVS Zener clamping voltage. No load on -48V output. Ch1: Input Feed A Voltage (20V/div). Ch3: VRTN_OUT w.r.t. -48V_OUT (20V/div). Ch 4: 3.3V_OUT (50mV/div).*

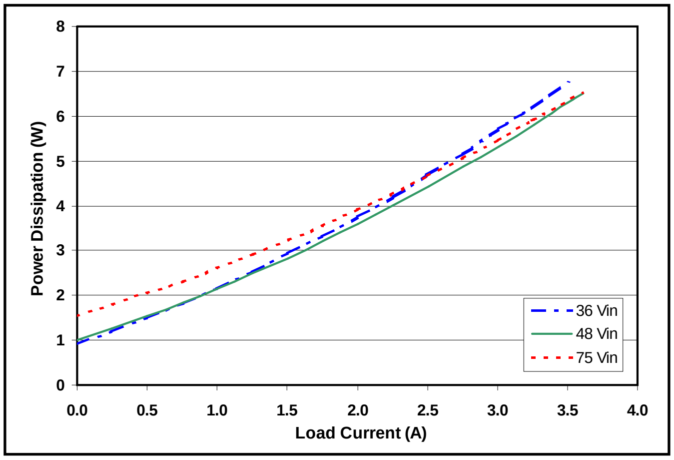


Figure 9: *Power dissipation vs. 3.3V load current with hot-swap switch enabled.*

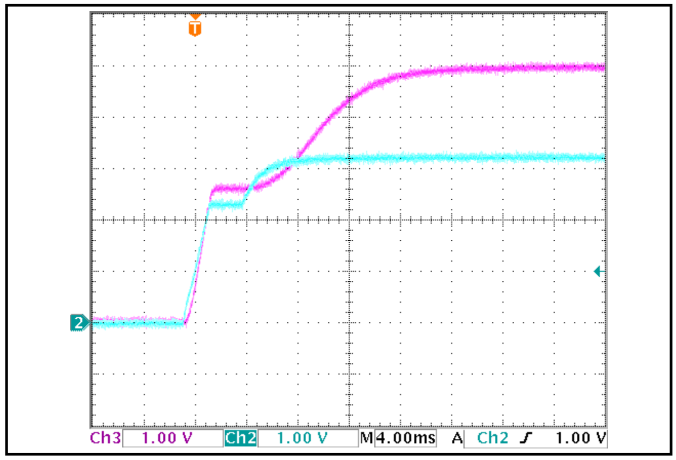


Figure 10: *Management Power turn on transient at 50% load (4ms/div). Load capacitance: 10uF ceramic capacitor. Ch 2: 3.3Vout (1V/div). Ch 3: 5.0Vout (1V/div).*

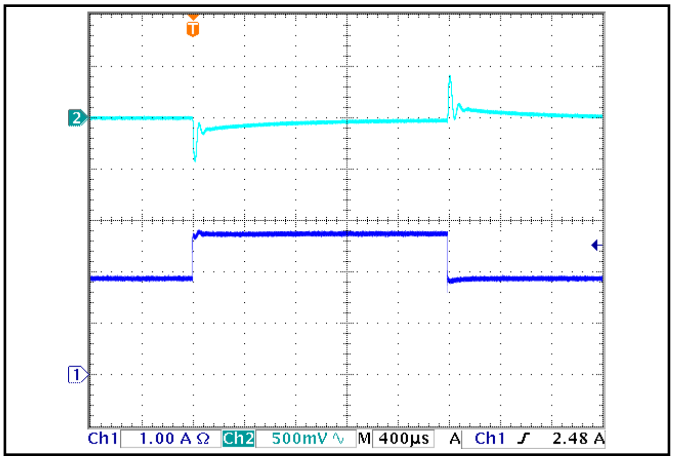


Figure 11: *3.3Vout response to a step-change in load current (50%-75%-50% of Iout(max): dI/dt = 1A/us). Load capacitance: 10uF ceramic capacitor. Top trace: 3.3Vout (500mV/div). Bottom trace: Iout (1A/div).*

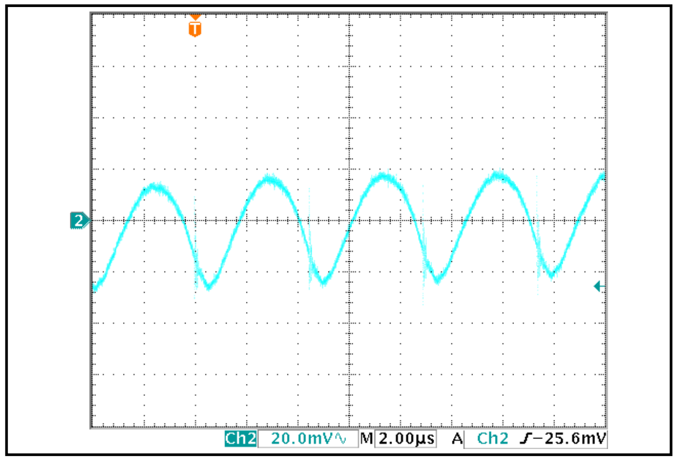


Figure 12: *3.3Vout ripple at nominal input voltage at rated load current (20mV/div). Load capacitance: 10uF ceramic capacitor. Bandwidth: 500MHz.*

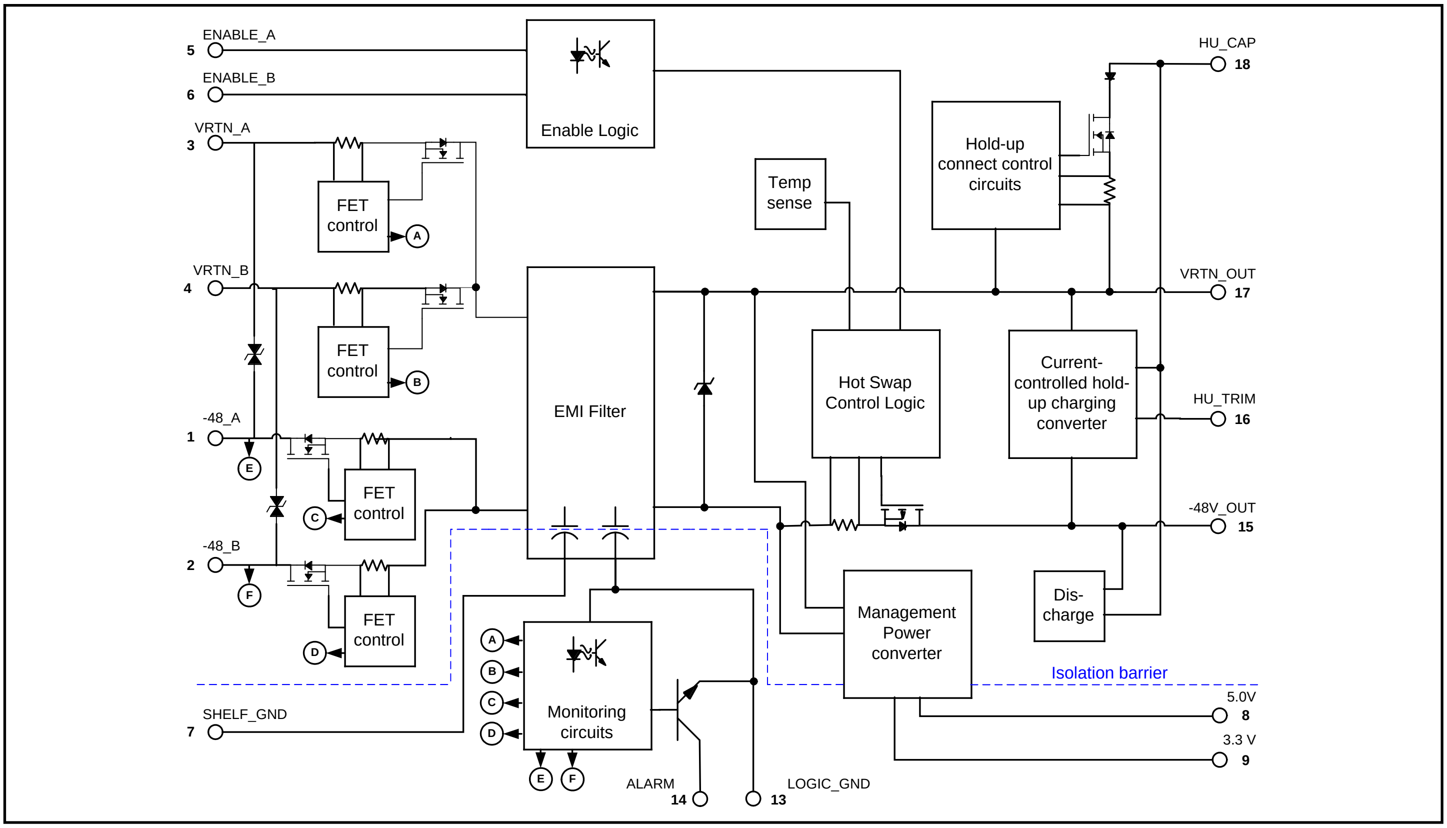


Figure A: Internal Block Diagram

FEATURE DESCRIPTIONS

Input ORing MOSFETs: ORing of dual -48V feeds is provided by four MOSFETs, which are individually controlled so as to operate as an ideal diode (see Figure A). If there is an input feed short of any kind, a control circuit will detect reverse current and turn off the MOSFET in 250ns (typ.), to avoid disturbing the other feed voltage. At zero current, the MOSFET is guaranteed to be off. In the case of a fuse failure, this triggers the ALARM output, due to an apparent input feed loss. Current hysteresis prevents limit cycling around the transition point between body diode and MOSFET conduction.

ALARM Output: The ALARM pin gives an external indication of a fault condition. It is an isolated and buffered open-collector output, which is normally pulled low. In the presence of either a MOSFET failure or an input feed loss (which can be caused by a fuse failure), the ALARM output will be tri-stated.

MOSFET Failure Detection: In addition to input feed loss, the ALARM output also indicates an Input ORing MOSFET failure. Each MOSFET has a separate circuit that detects the gate impedance, independent of whether the MOSFET is on or off. Below a threshold of about 3kΩ, the gate-source oxide is determined to be compromised, and the ALARM output is tri-stated. This method of detection is preferable because the vast majority of MOSFET failures compromise the delicate gate oxide layer. Alternate detection methods invariably lose coverage depending on the relative input feed voltage; it is difficult to tell the difference between a shorted MOSFET, and a MOSFET that would normally be turned on anyway, given the current operating condition.

External Input Fuse Failure Detection: At zero current, the input ORing MOSFETs are guaranteed to be off. In the case of a fuse failure, an on-board bleed resistor pulls the input feed voltage down. This triggers the ALARM output due to an apparent input feed loss. There are two main down-sides to this approach. First, there is no way to distinguish between a feed loss and a fuse failure. Second, an enable fuse loss is not detected, since the enables are diode OR'd.

The full featured version of the iQor offers additional data reporting that makes full fuse detection possible. Among other data, each feed voltage and each enable voltage is reported through the I^{2}C port. These voltages can be compared with the voltages reported by the shelf manager to determine whether any board fuse is blown.

Input Enable: The ENABLE_A/B signals connect to VRTN_A/B on the backplane via the shortest pins in the zone 1 connector. They are the last pins to mate during board insertion, and the first to disconnect during board extraction. The ENABLE_A and ENABLE_B signals are diode-ORed together which lets either signal enable the module. Whenever both ENABLE pins are open, the hot-swap switch is opened. This prevents -48V output power from being drawn though the EARLY pre-charge resistors.

The ENABLE signals also control the management power. On board insertion, the management power remains off until at least one of ENABLE_A/B is connected. On board extraction, the management power is disabled at the end of the 100ms hold-up period, and remains off until ENABLE_A/B is reconnected. This prevents the IPMI controller from reading an invalid hardware address when a board is partially inserted. Management power flows through the EARLY pre-charge resistors for a maximum of 100ms, which provides a margin similar to the pre-charge event in terms of resistor safe-operating-area.

EARLY Precharge Resistors: The EARLY_A/B signals connect to the longest pins in the zone 1 power connector, and therefore first to mate during board insertion. External resistors connected between these signals and VRTN_A/B allow the relatively small EMI filter capacitance to be pre-charged before the main power pins make contact. A 100Ω surge rated 2010 case size resistor is recommended (KOA SG73 series or equivalent).

Hot Swap - Thermal Shutdown: To protect the unit from damage in an abnormal thermal environment, the hot-swap switch will be disabled when the thermal sensor temperature rises above the turn-off threshold. The switch will be automatically enabled again when the temperature goes below the turn-on threshold. The management power remains on during an over-temperature condition.

The full featured version of the iQor reports the actual temperature through the I^2C port.

Hot Swap - Over-Current Protection: If the -48V output current rises above the current limit threshold, the hot-swap switch will be disabled, and will immediately enter another soft-start sequence. If an output short is detected, the hot-swap switch will be disabled and will enter a hiccup mode of operation with automatic restart.

The full featured version of the iQor reports actual output current through the I^2C port.

Hot Swap - Transient Suppression: Input transient events can occur if there is a short on an adjacent board or backplane. The short builds up a large current in the wiring inductance, and when a fuse blows, the voltage behind the fuse spikes very quickly. This can cause a loss of redundancy since many other boards could be exposed to this spike.

The iQor unit conditions the -48V output, providing for seamless ride-through of input voltage transients. If the positive dV/dt of the input voltage is too high, the hot-swap switch will be disabled and will immediately enter another soft-start sequence. This limits the dV/dt seen on the -48V output, which prevents the 12V payload power converter from having such a large glitch on its output that it shuts down. The -48V output hold-up function remains active throughout, in case the hot-swap switch is forced off for too long.

Passive Transient Suppression: Each input feed has a dedicated internal bidirectional TVS zener diode, rated for a minimum clamp voltage of 77.8V at 1mA. A TVS diode short due to electrical overstress will not disable the iQor module: a fuse will open, and the module can continue to run from the other feed.

External Hold-up Capacitor Charge: A current controlled DC-DC converter charges the external hold-up capacitor to a voltage of 50V-95V, set by an external resistor. The charge voltage can range either above or below the input feed voltage. Constant current charging takes place whenever the hot-swap switch is enabled.

Hold-up Capacitor Connect: When the hot-swap switch is enabled, 2 seconds are allocated to charge the hold-up capacitor. After this time, a comparator is armed, which connects the hold-up capacitor to the -48V output should the output ever drop below the given connect threshold. A current limit circuit protects against damage during a short circuit condition. A dV/dt limit circuit regulates the hold-up connect switch turn-on speed. When the comparator is tripped, the hold-up connect switch remains closed for 100ms, is off for 2 seconds to allow the hold-up capacitor to recharge, and then is automatically rearmed (if the output voltage is above the given arm threshold).

Hold-up Capacitor Discharge: Whenever the hot-swap switch is disabled, an internal resistor bank is connected across the hold-up capacitor. This is intended to reduce the voltage on the hold-up capacitor below 60V within 1 second.

Management Power: An isolated management power converter delivers both 3.3V and a low power 5.0V relative to LOGIC_GND. Over-current protection operates in constant current with a hiccup mode if the output voltage drops too far. Output over-voltage circuitry is included with a redundant reference and optocoupler.

Hot Swap – Shutdown Timing: In the event of a sudden loss of input voltage (see Figure B), a hold-up event will be triggered. When the output voltage (plus a diode drop for the hot-swap body diode) decays to the management power under-voltage turn-off threshold, the main -48V output and the 3.3V/5.0V outputs will shut down simultaneously.

In the event of a gradual loss of input voltage (see Figure C), the main -48V output will shut down 100ms after the beginning of the hold-up event. The -48V output will enter a hiccup mode of operation for input voltages below the Hold-up Arm Threshold. Management power will continue to run until the input voltage (plus 0V to 1.2V for the ORing MOSFETs) decays to the management power under-voltage turn-off threshold.

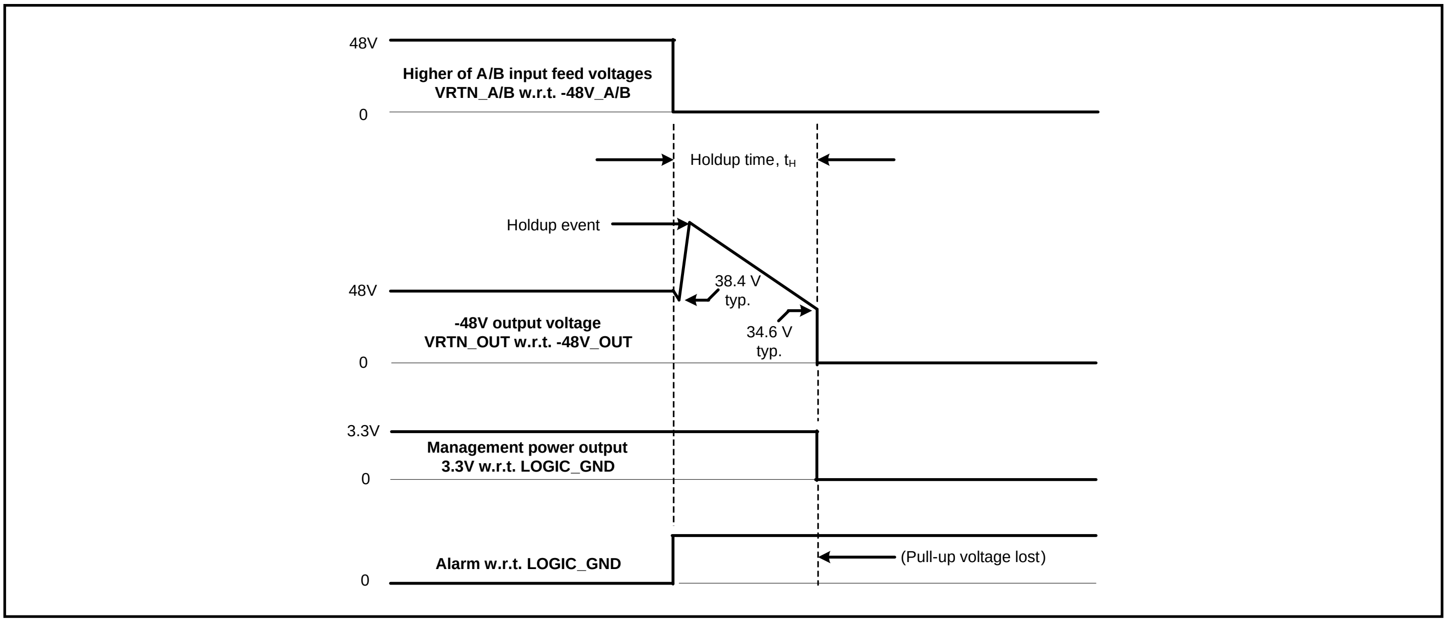


Figure B: *Sudden Loss of Input Power*

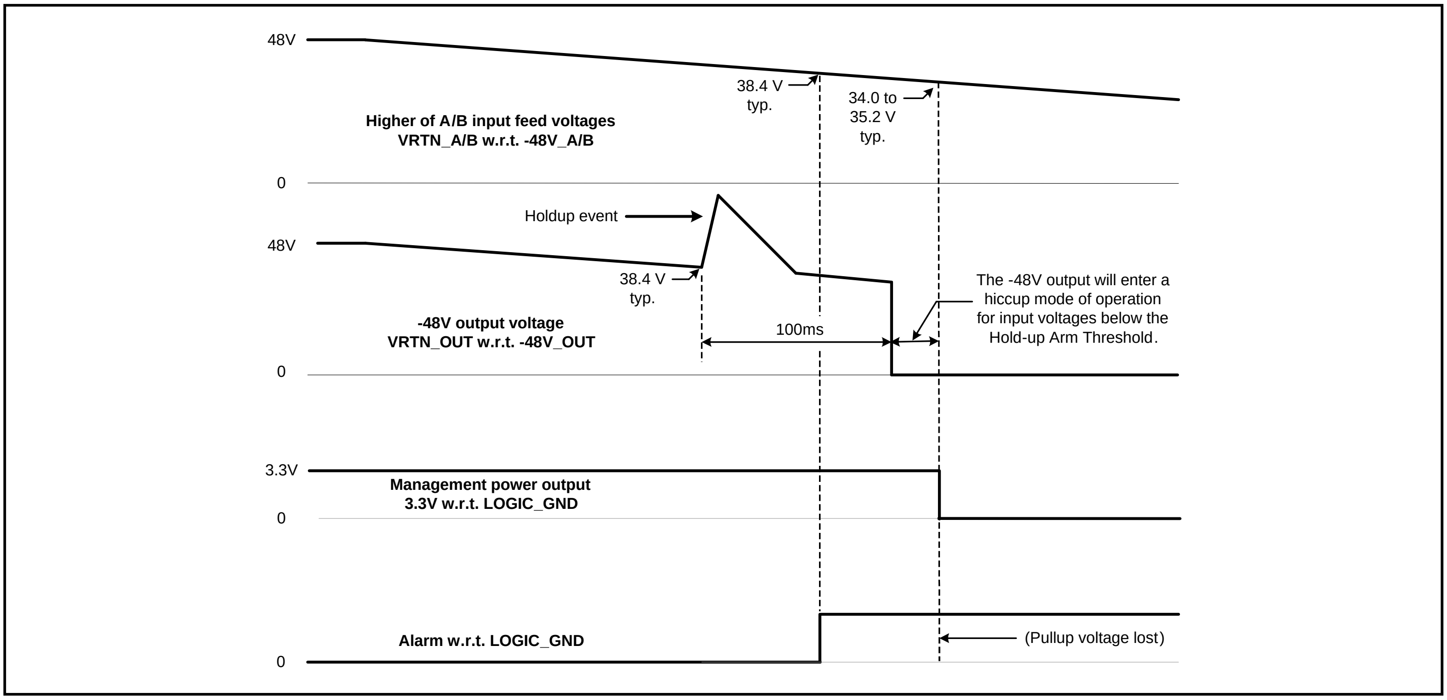


Figure C: *Gradual Loss of Input Power*

EXTERNAL HOLD-UP CAPACITOR SELECTION

C_H is the hold-up capacitance (electrolytic capacitors typically have a ±20% tolerance):

$$C_H = \frac{2t_H P_H}{V_H^2 - V_U^2} \qquad \textbf{Equation A}$$

Typically a strong function of V_H (see Figure D).
The ATCA specification requirement is 8.70ms (see Figure E).

Where:
V_H = hold-up capacitor charge voltage.
V_U = minimum operating voltage on the 48V output; the greater of the under-voltage lockout threshold of the payload power converter, and the under-voltage lockout threshold of the management power converter.
t_H = time from when the highest input feed voltage drops below V_F, to the time when the highest input feed voltage rises above V_U.
V_F = voltage at which the hold-up capacitor is engaged.
P_H = power drawn from the hold-up capacitor, the sum of the input power of the payload power converter, and the input power of the 3.3V mgmt power converter (see Figure 9):

$$P_H = \frac{P_{OUT12V}}{\eta_{12V}} + P_{IN3.3V} \qquad \textbf{Equation B}$$

P_{OUT12V} = output power delivered by the payload converter.
η_{12V} = efficiency of the 12V payload converter.
$P_{IN3.3V}$ = 3.3V input management converter power.

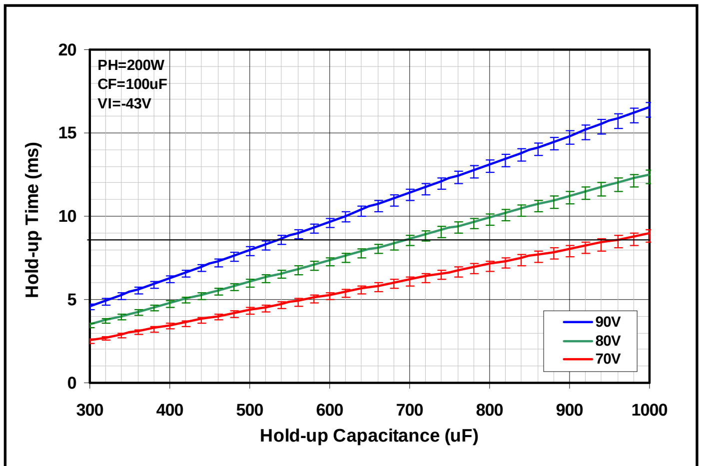


Figure D: Hold-up Time (ms) vs. Hold-up Capacitance (ì F) at Hold-up Charge Voltages of 70V, 80V, and 90V (see Equation A). The AdvancedTCA hold-up time requirement is at most 8.70ms (solid horizontal line). The capacitor tolerance is not factored into this result. Error bars indicate the worst case range of hold-up time for a given hold-up capacitance.

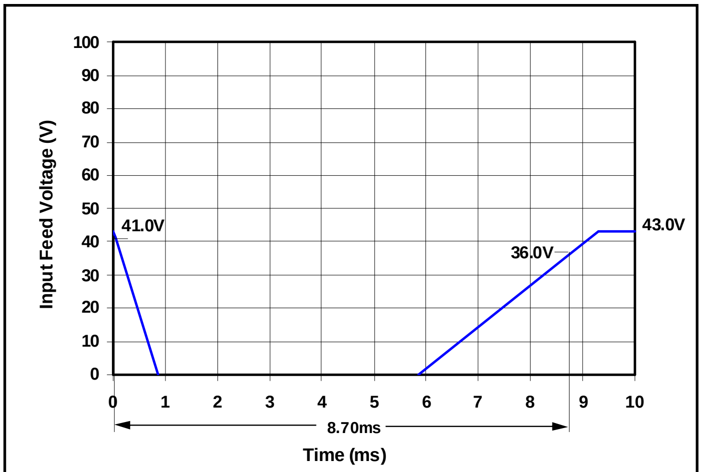


Figure E: The PICMG 3.0 R2.0 AdvancedTCA Base Specification requires continuous operation through a zero-volt transient, lasting 5ms (Section 4.1.2.2). However, this is not a square wave: the voltage starts at a minimum amplitude of -43V, falls at 50V/ms, remains at 0V for 5ms, and then rises at 12.5V/ms. At the worst case values of the hold-up connect threshold and the management power under-voltage lockout threshold, the required hold-up time is 8.70ms.

EXTERNAL HOLD-UP CAPACITOR VOLTAGE RATING

Operating electrolytic capacitors near their voltage rating **does not** affect their reliability, as it does with tantalum or ceramic type capacitors. The operating life of electrolytic capacitors is primarily determined by the capacitor internal temperature. The capacitor lifetime roughly doubles for every 10°C reduction in internal temperature. SynQor recommends running 100V rated electrolytic capacitors at 90V, which dramatically increases hold-up time for a given capacitor volume (see Figure D). A built-in circuit automatically discharges the hold-up capacitor when the input voltage is removed.

EXTERNAL HOLD-UP TRIM RESISTOR SELECTION

R_{trim} is the external hold-up trim resistance for a given desired nominal hold-up capacitor charge voltage (V_{HU}) (see Figure F):

$$R_{trim} = \left(\frac{500{,}000}{V_{HU} - 50.0} - 10{,}000 \right) \Omega \qquad \textit{Equation C}$$

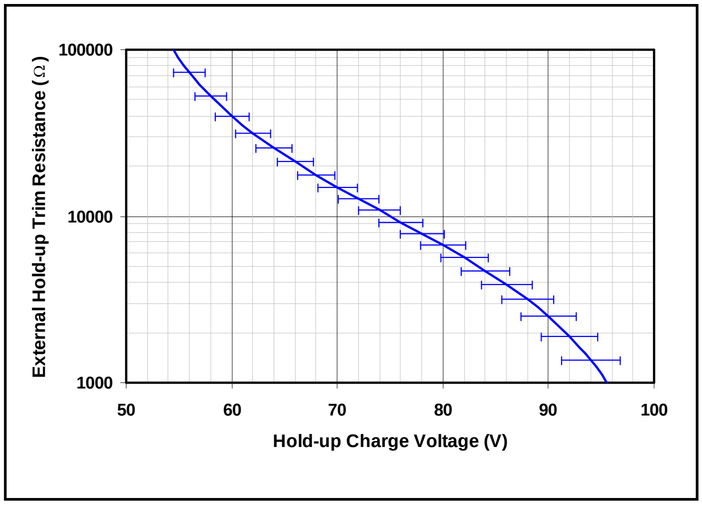


Figure F: *Plot of Equation C, used to choose the external trim resistor value based on the desired Hold-up Capacitor charge voltage. Error bars indicate the worst case range of charge voltage for a given external trim resistor value (assumes 1%, 100ppm for external trim resistor tolerance). Worst case calculation over temp range -40ºC to 125ºC.*

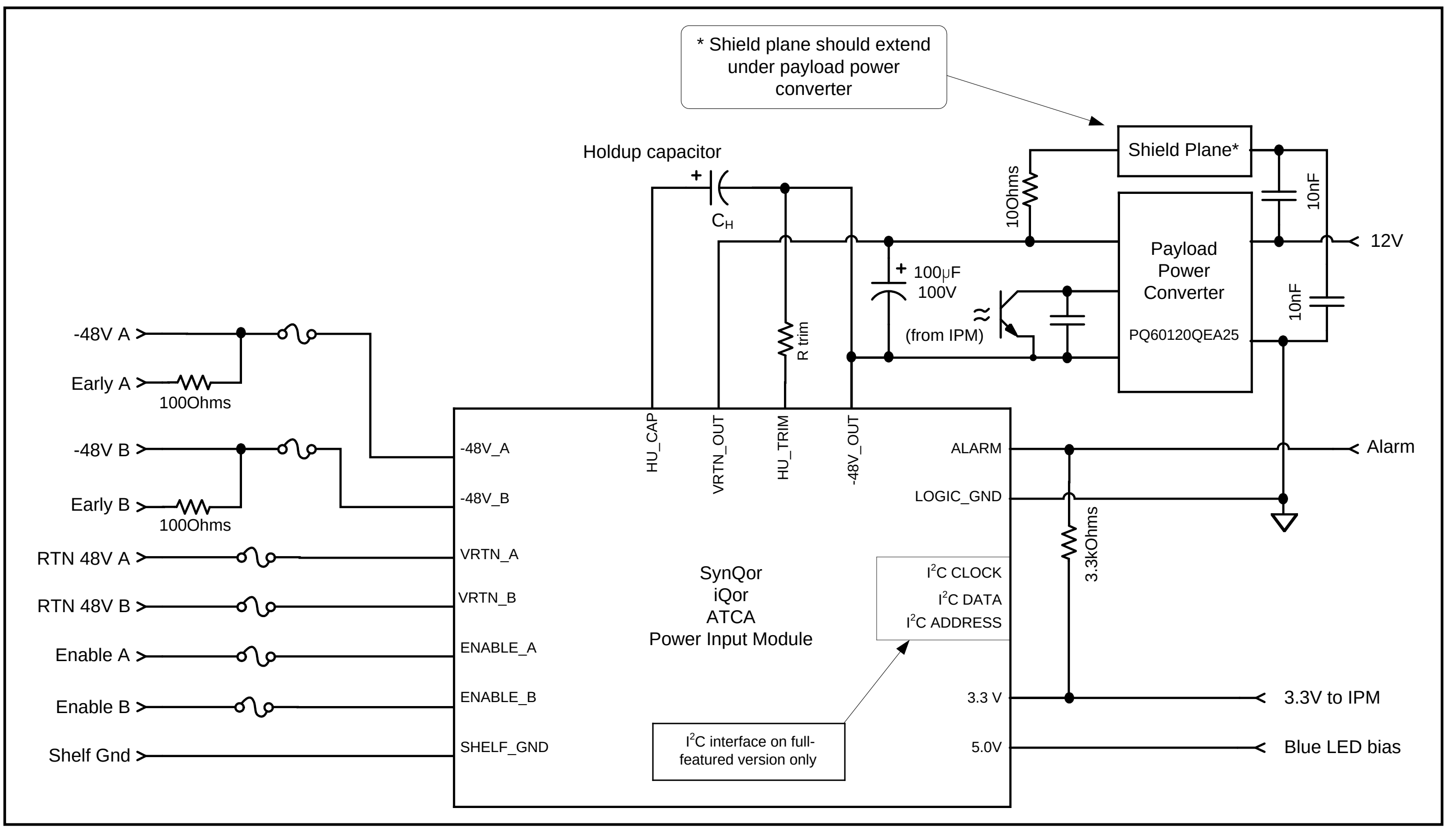


Figure G: *Application Diagram*

PART NUMBERING SYSTEM

The part numbering system for SynQor's iQor Power Interface Module follows the format shown in the example below.

IQ 6 50 33 Q M A 10 S N S - G

- IQ — Product Family
- 6 — Input Voltage
- 50 — Output Voltage 1
- 33 — Output Voltage 2
- Q — Package Size
- M — Performance Level
- A — Thermal Design (see Ordering Info)
- 10 — Output Current
- S N S — Options (see Ordering Information)
- G — 6/6 RoHS

The first 12 characters comprise the base part number and the last 3 characters indicate available options. Although there are no default values for enable logic and pin length, the most common options are negative logic and 0.145" pins. These part numbers are more likely to be readily available in stock for evaluation and prototype quantities. A "-G" suffix indicates 6/6 RoHS compliance.

PATENTS (additional patent applications may be filed)

SynQor holds the following patents, one or more of which might apply to this product:

5,999,417	6,222,742	6,545,890	6,577,109
6,594,159	6,731,520	6,894,468	6,896,526
6,927,987	7,050,309	7,072,190	7,085,146

ORDERING INFORMATION

The tables below show the valid model numbers and ordering options for modules in this product family. When ordering SynQor modules, please ensure that you use the complete 15 character part number consisting of the 12 character base part number and the additional 3 characters for options. A "-G" suffix indicates the product is 6/6 RoHS compliant.

Model Number	Input Voltage	MGMT Power	36-75V Input/Output Current
IQ65033QMA10*xyz*	36 - 75 V	5.0V & 3.3 V	10 A

The following option choices must be included in place of the *x y z* spaces in the model numbers listed above.

Options Description: *x y z*		
Enable Logic	**Pin Length**	**Feature Set**
S - Standard	K - 0.110" N - 0.145" R - 0.180" Y - 0.250"	S - Standard F - Full Feature

RoHS Compliance: The EU led RoHS (Restriction of Hazardous Substances) Directive bans the use of Lead, Cadmium, Hexavalent Chromium, Mercury, Polybrominated Biphenyls (PBB), and Polybrominated Diphenyl Ether (PBDE) in Electrical and Electronic Equipment. This SynQor product is 6/6 RoHS compliant. For more information please refer to SynQor's RoHS addendum available at our RoHS Compliance / Lead Free Initiative web page or e-mail us at rohs@synqor.com.

Application Notes

A variety of application notes and technical white papers can be downloaded in pdf format from our website.

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Warranty
SynQor offers a three (3) year limited warranty. Complete warranty information is listed on our website or is available upon request from SynQor.